

PRELIMINARY DATA
LED DISPLAY DRIVER

- .33 OUTPUTS, 15 mA SINK CAPABILITY
- CURRENT GENERATOR OUTPUTS (NO EXTERNAL RESISTORS REQUIRED)
- CONTINUOUS BRIGHTNESS CONTROL
- SERIAL DATA INPUT-OUTPUT
- ENABLE INPUT
- CASCADE OPERATION CAPABILITY
- WIDE SUPPLY VOLTAGE OPERATION
- TTL COMPATIBILITY

Application examples:

- MICROPROCESSOR DISPLAYS
- INDUSTRIAL CONTROL INDICATOR
- RELAY DRIVER
- INSTRUMENTATION READOUTS

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The M5486 is a monolithic MOS integrated circuits produced with an N-channel silicon gate technology. It is available in a 40-pin dual in-line plastic package.

A single pin controls the LED display brightness by setting a reference current through a variable resistor connected to V_{DD} or to a separate supply of 13.2V maximum.

The M5486 is an improved pin-to-pin replacement of the NS MM 5486.

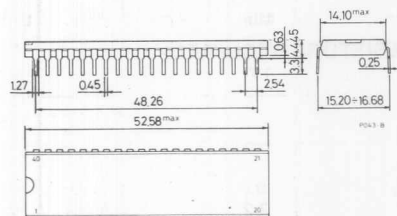
ABSOLUTE MAXIMUM RATINGS

V_{DD}^*	Supply voltage	-0.3 to 20	V
V_I	Input voltage	-0.3 to 20	V
$V_{O(off)}$	Off state output voltage	20	V
I_O	Output sink current	40	mA
P_{tot}	Total package power dissipation	at 25°C 1W at 85°C 560 mW	
T_j	Junction temperature	150	°C
T_{op}	Operating temperature range	-25 to 85	°C
T_{stg}	Storage temperature range	-65 to 150	°C

Stresses above those listed under "Absolute Maximum Ratings" may causes permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

* All voltages are with respect to V_{SS} (GND)

ORDERING NUMBERS: M5486 B7

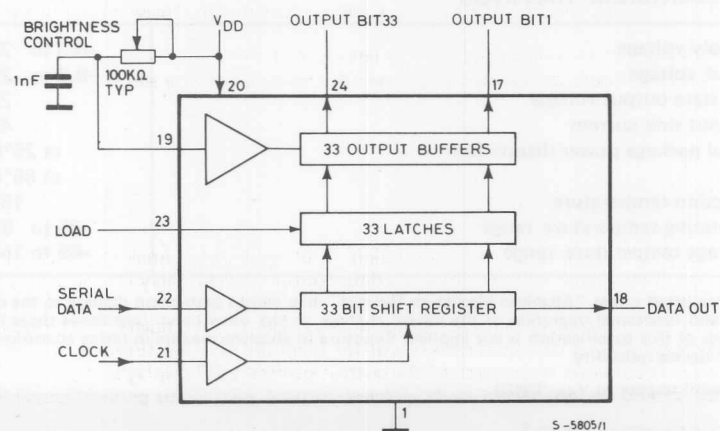
MECHANICAL DATA (dimensions in mm.)

PIN CONNECTIONS

V _{SS}	1	40	OUTPUT BIT 17
OUTPUT BIT 16	2	39	OUTPUT BIT 18
OUTPUT BIT 15	3	38	OUTPUT BIT 19
OUTPUT BIT 14	4	37	OUTPUT BIT 20
OUTPUT BIT 13	5	36	OUTPUT BIT 21
OUTPUT BIT 12	6	35	OUTPUT BIT 22
OUTPUT BIT 11	7	34	OUTPUT BIT 23
OUTPUT BIT 10	8	33	OUTPUT BIT 24
OUTPUT BIT 9	9	32	OUTPUT BIT 25
OUTPUT BIT 8	10	31	OUTPUT BIT 26
OUTPUT BIT 7	11	30	OUTPUT BIT 27
OUTPUT BIT 6	12	29	OUTPUT BIT 28
OUTPUT BIT 5	13	28	OUTPUT BIT 29
OUTPUT BIT 4	14	27	OUTPUT BIT 30
OUTPUT BIT 3	15	26	OUTPUT BIT 31
OUTPUT BIT 2	16	25	OUTPUT BIT 32
OUTPUT BIT 1	17	24	OUTPUT BIT 33
DATA OUT	18	23	LOAD
BRIGHTNESS CONTROL	19	22	DATA IN
V _{DD}	20	21	CLOCK IN

S-5799

BLOCK DIAGRAM

Fig. 1



S-5805/1

**M5486****STATIC ELECTRICAL CHARACTERISTICS** (T_{amb} within operating range, $V_{DD} = 4.75V$ to $13.2V$, $V_{SS} = 0V$, unless otherwise specified)

Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{DD} Supply Voltage		4.75		13.2	V
I_{DD} Supply Current	$V_{DD} = 13.2V$			7	mA
V_I Input Voltages Logical "0" Level Logical "1" Level	$\pm 10 \mu A$ input bias $4.75 \leq V_{DD} \leq 5.25$ $V_{DD} > 5.25$	-0.3 2.2 $V_{DD}-2$		0.8 V_{DD} V_{DD}	V V V
I_B Brightness Input Current (note 2)		0		0.75	mA
V_B Brightness Input Voltage (pin 19)	Input current = $750 \mu A$	3		4.3	V
$V_{O(off)}$ Off State Out. Voltage				18	V
I_O Out Sink Current (note 3) Segment OFF Segment ON	$V_O = 3V$ $V_O = 1V$ (note 4) Brightness In. = $0 \mu A$ Brightness In. = $100 \mu A$ Brightness In. = $750 \mu A$	0 2 15	2.7	10 10 4 25	μA μA mA mA
f_{clock} Input Clock Frequency		0		0.5	MHz
I_O Output Matching (note 1)				± 20	%

- Notes :**
1. Output matching is calculated as the percent variation from $I_{MAX} + I_{MIN}/2$.
 2. With a fixed resistor on the brightness input some variation in brightness will occur from one device to another.
 3. Absolute maximum for each output should be limited to 40 mA.
 4. The V_O voltage should be regulated by the user. See figures 6 and 7 for allowable V_O versus I_O operation.

FUNCTIONAL DESCRIPTION

The M5486 is specifically designed to operate 4 digit displays with minimal interface with the display and the data source. Serial data transfer from the data source to the display driver is accomplished with 3 signals, serial data, clock and load.

The 33 data bits are latched by a positive pulse, thus providing non-multiplexed, direct drive to the display. Outputs change only if the serial data bits differ from the previous time.

Display brightness is determined by control of the output current LED displays.

A 1nF capacitor should be connected to brightness control, pin 19, to prevent possible oscillations.

A block diagram is shown in figure 1.

The output current is typically 20 times greater than the current into pin 19, which is set by an external variable resistor. There is an internal limiting resistor of 400Ω nominal value.

**FUNCTIONAL DESCRIPTION** (continued)

Figures 2 and 3 show the input data format. Bit "1" is the first bit into the data input pin and it will appear on pin 17. A logical "1" at the input will turn on the appropriate LED.

The Load signal latches the 33 bits of the shift registers into the latches. The data out pin allows for cascading the shift registers for more than 33 output drivers.

When power is first applied to the chip an internal power ON reset signal is generated which resets all registers and all latches. The first clock returns the chip to its normal operation.

Figure 4 shows the timing relationship between data, clock and load. A max clock frequency of 0.5 MHz is assumed.

For applications where a lesser number of outputs are used, it is possible to either increase the current per output, or operate the part at higher than 1V V_{OUT} .

The following equation can be used for calculations.

$$T_j = [(V_{OUT}) (I_{LED}) (\text{No. of segments}) + (V_{DD} \cdot 7 \text{ mA})] (124^\circ\text{C/W}) + T_{amb}$$

where:

T_j = junction temperature (+150°C max)

V_{OUT} = the voltage at the LED driver outputs

I_{LED} = the LED current

124°C/W = thermal coefficient of the package

T_{amb} = ambient temperature

The above equation was used to plot figures 5, 6 and 7.

Fig. 2 - Input Data Format

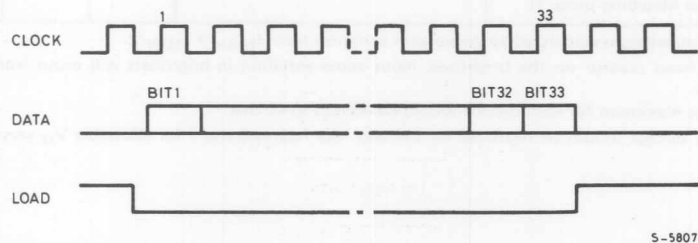


Fig. 3

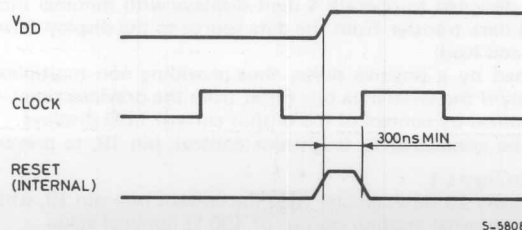
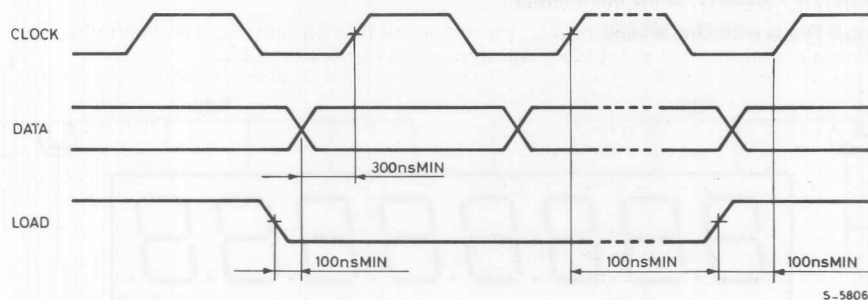
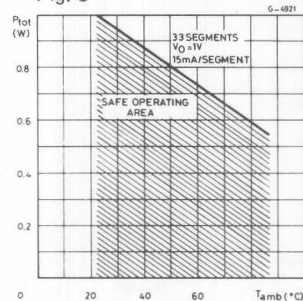
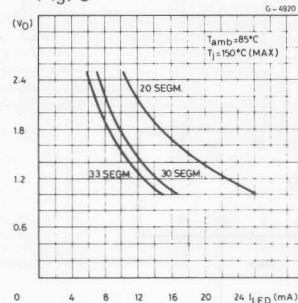
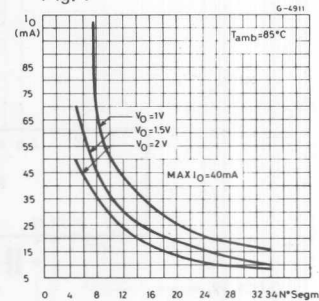
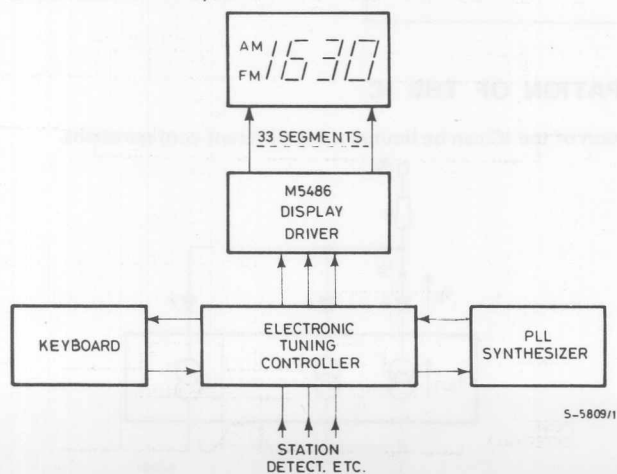


Fig. 4

Fig. 5

Fig. 6

Fig. 7


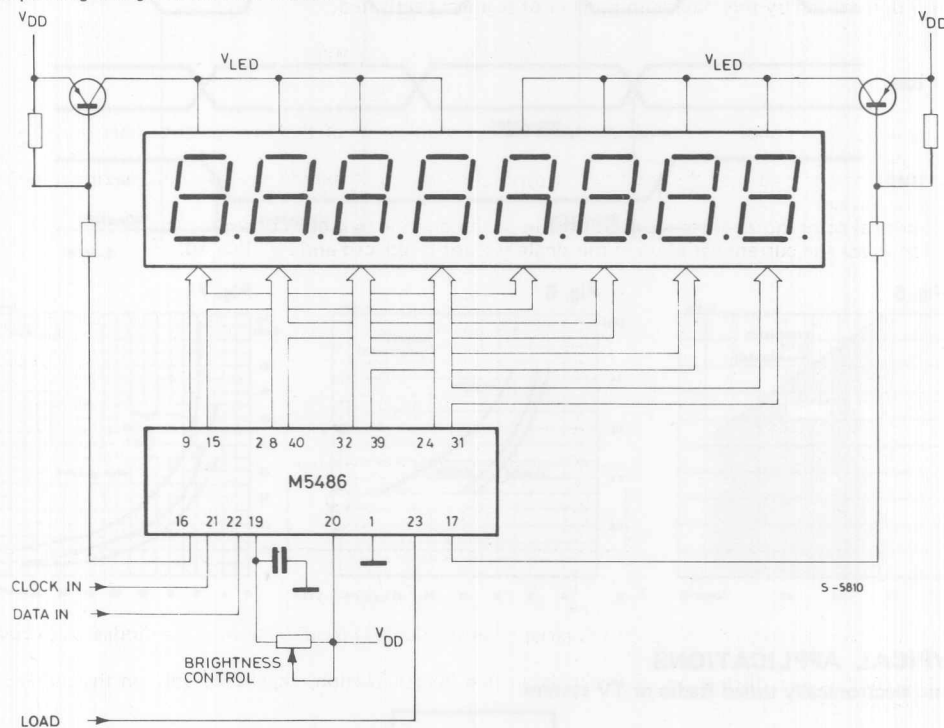
TYPICAL APPLICATIONS

Basic electronically tuned Radio or TV system



TYPICAL APPLICATIONS (continued)

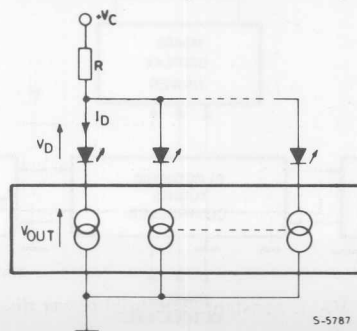
Duplexing 8 Digits with One M5486



POWER DISSIPATION OF THE IC

The power dissipation of the IC can be limited using different configurations.

a)



In this application R must be chosen taking into account the worst operating conditions. R is determined by the maximum number of segments activated.

$$R = \frac{V_C - V_{D \text{ MAX}} - V_{O \text{ MIN}}}{N_{\text{MAX}} \cdot I_D}$$

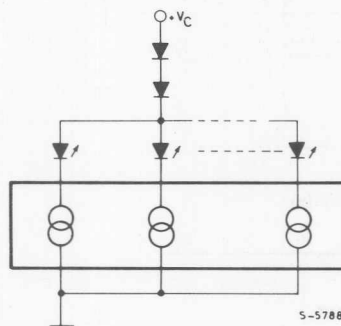
The worst case condition for the device is when roughly half of the maximum number of segments are activated.

It must be checked that the total power dissipation does not exceed the absolute maximum ratings of the device.

In critical cases more resistors can be used in conjunction with groups of segments.

In this case the current variation in the single resistor is reduced and P_{tot} limited.

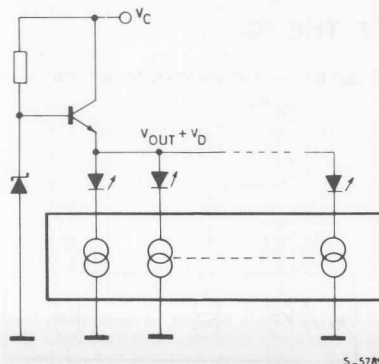
b)



In this configuration the drop on the serial connected diodes is quite stable if the diodes are properly chosen.

The total power dissipation of the IC is, in first approximation, depending only on the number of segments activated.

c)



In this configuration $V_{\text{OUT}} + V_D$ is constant. The total power dissipation of the IC depends only on the number of segments activated.



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